

CLAIMS

What is claimed is:

1. An apparatus for etching stacks on a substrate, comprising:
  - a plasma chamber with chamber walls;
  - 5 a plasma confinement device for reducing plasma contact with the chamber walls;
  - a gas source, comprising:
    - a fluorine containing gas source;
    - an ammonia containing gas source;
    - plasma generation and energizing device; and
  - 10 an exhaust system for pumping plasma away.
2. The apparatus, as recited in claim 1, further comprising a chuck for supporting the substrate within the plasma chamber, wherein the plasma confinement device confines the plasma adjacent to the substrate.
- 15 3. The apparatus, as recited in claim 2, wherein the stack comprises a layer with a low dielectric constant material and an etch stop layer.
4. The apparatus, as recited in claim 3, wherein the plasma generation and energizing device comprises an upper electrode and a lower electrode spaced apart from the upper electrode.

5. The apparatus, as recited in claim 4, wherein the plasma confining device comprises a plurality of spaced apart plasma rings.

6. The apparatus, as recited in claim 5, wherein the upper electrode and lower electrode  
5 are spaced apart by a distance less than 2.0 cm.

7. The apparatus, as recited in claim 6, wherein the exhaust system is able to maintain a pressure below 300 mTorr within the chamber walls.

10 8. The apparatus, as recited in claim 1, wherein the plasma generation and energizing device comprises an upper electrode and a lower electrode spaced apart from the upper electrode.

15 9. The apparatus, as recited in claim 8, wherein the plasma confining device comprises a plurality of spaced apart plasma rings.

10. The apparatus, as recited in claim 9, wherein the upper electrode and lower electrode are spaced apart by a distance less than 2.0 cm.

20 11. The apparatus, as recited in claim 10, wherein the exhaust system is able to maintain a pressure below 300 mTorr within the chamber walls.

12. The apparatus, as recited in claim 8, wherein the upper electrode and lower electrode are spaced apart by of distance less than 2.0 cm.

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14. The apparatus, as recited in claim 1, wherein the plasma confining device comprises a plurality of spaced apart plasma rings.

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15. The apparatus, as recited in claim 14, wherein the exhaust system is able to maintain a pressure below 300 mTorr within the chamber walls.

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16. A method of etching a stack, comprising:  
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placing the stack in a plasma processing chamber;  
flowing a fluorine containing gas into the plasma processing chamber;  
10 flowing an ammonia containing gas into the plasma processing chamber;  
generating a plasma; and  
etching the stack.

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17. The method, as recited in claim 11, further comprising confining the plasma to reduce 15 plasma contact with chamber walls.

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18. The method, as recited in claim 12, wherein the stack comprises a low dielectric constant layer and an etch stop layer over a substrate.

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19. The method, as recited in claim 17, wherein the fluorine containing gas and the ammonia containing gas are provided in an alternating manner and wherein a plasma is generated from the fluorine containing gas and a plasma is generated from the ammonia containing gas.

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